Formerly Utilized MED/AEC Sites Remedial Action Program

Removal of a Contaminated Industrial Waste Line, Los Alamos, New Mexico

April 1979

Final Report

Prepared for

U.S. Department of Energy
Assistant Secretary for Environment
Division of Environmental Control Technology
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PREFACE

This series of reports results from a program initiated in 1974 by the Atomic Energy Commission (AEC) for determination of the condition of sites formerly utilized by the Manhattan Engineer District (MED) and the AEC for work involving the handling of radioactive materials. Since the early 1940's, the control of over 100 sites that were no longer required for nuclear programs has been returned to private industry or the public for unrestricted use. A search of MED and AEC records indicated that for some of these sites, documentation was insufficient to determine whether or not the decontamination work done at the time nuclear activities ceased is adequate by current guidelines.

This report contains data and information on the methods used in excavation, decontamination and removal of contaminated underground waste lines utilized during the Manhattan Project and early work done by the AEC. This report documents the location of the remaining portions of this industrial waste line so that any future excavation of these current inaccessible areas can be conducted without undue concern.

This report was compiled by the following members of the Environmental Surveillance Group, Health Research Division, Los Alamos Scientific Laboratory.

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APPENDIXES

FIGURES

TABLES

REMOVAL OF A CONTAMINATED INDUSTRIAL WASTE LINE AT LOS ALAMOS, NEW MEXICO

ABSTRACT

In 1977 parts of an abandoned industrial waste line (IWL) that carried laboratory or process chemical and radiochemical wastes were removed from Los Alamos Scientific Laboratory property and from the townsite of Los Alamos in north-central New Mexico. Most of the IWL was removed between 1964 and 1967. Some IWL segments in the townsite, which at that time were buried under newly paved roads, were left for removal during future construction projects involving these roads to minimize traffic problems and road damage, and because they posed no public health hazard. In 1977, prior to impending major road construction in several areas, 400 m (1300 ft) of IWL and two IWL manhole structures were removed from Laboratory and Los Alamos County property. Associated soil contamination was removed to levels considered to be as low as practicable. Contaminated or potentially contaminated material was removed to an approved radioactive waste disposal site on Department of Energy property. Full details of the methods, findings, and as-left conditions are documented *in this report.*

I. INTRODUCTION

A. Background

An industrial waste line (IWL) carried wastes from Technical Area 3 (TA-3), TA-48, TA-43, and TA-1 of the Los Alamos Scientific Laboratory (LASL) to a chemical waste treatment plant at TA-45 located near downtown Los Alamos, New Mexico (Fig. 1). In 1963 treatment of TA-3 and TA-48 waste was transferred from TA-45 to improved facilities at TA-50. TA-43 wastes, being so dilute, were directed to the sanitary sewer system. Decommissioning of TA-1 was completed in 1965. These changes eliminated need for an IWL connection from TA-3, TA-48, TA-43, and TA-1 to TA-45 (Figs. 2-4). Most of the IWL was removed during 1965-67. However, some sections were left in place to avoid major repairs on newly paved roads and traffic disruption, and because these sections posed no public health hazard.

Early in 1977 the Los Alamos County Council advertised for bids on an improvement project for the intersection of Diamond and Trinity Drives, which covered most remaining portions of the IWL. Since this improvement required that the intersection be completely torn up, the Department of Energy (DOE) and LASL's administration decided it was an opportune time to remove those remaining IWL portions (~400 m) in the vicinity of the intersection. The Los Alamos County Council agreed, so the 11-week project was started in March 1977.

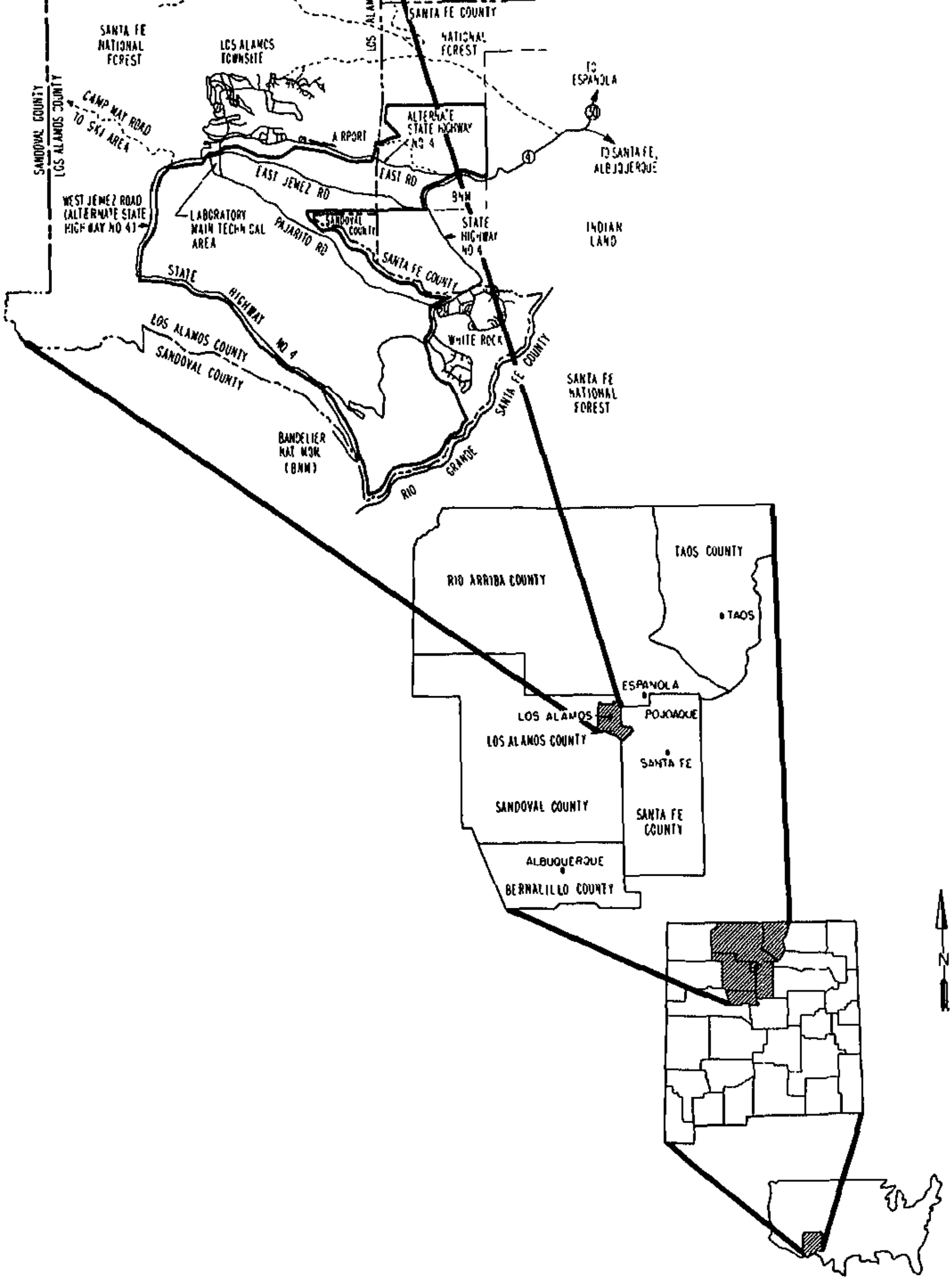

Fig. 1.
Relative location of LASL in north-central New Mexico.

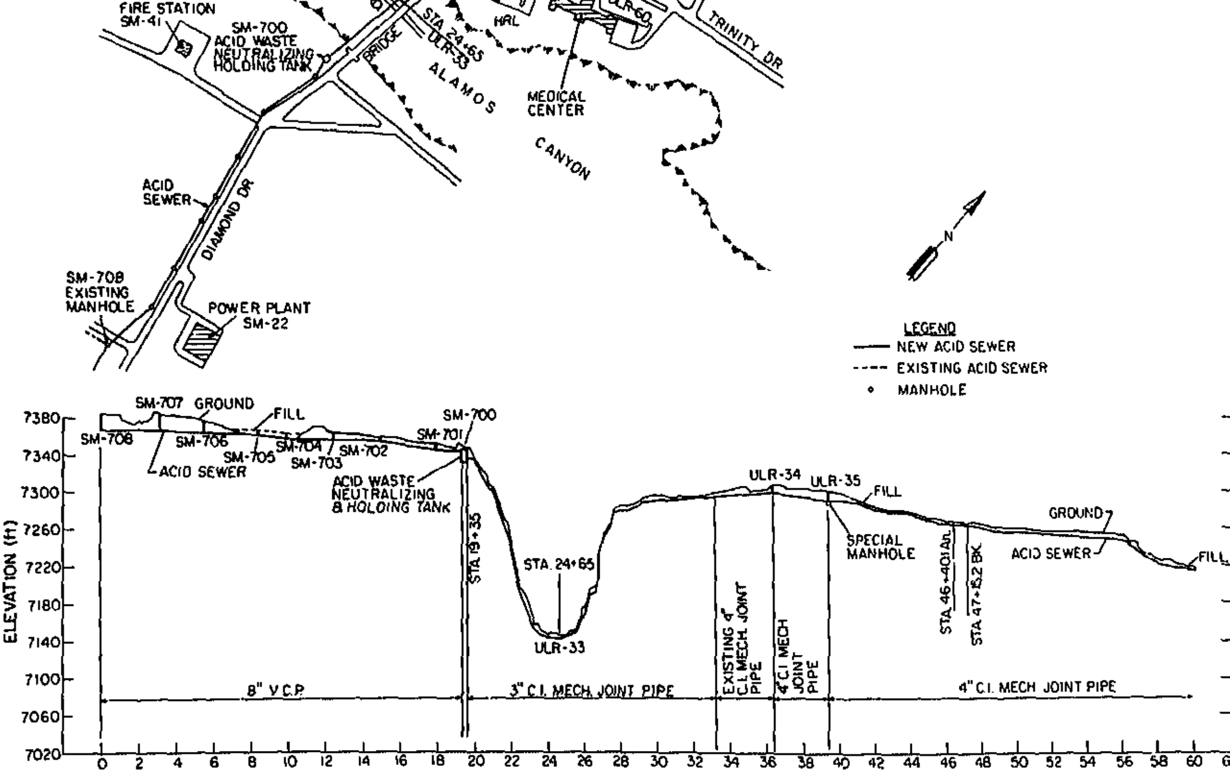

Fig. 2.
Condensed plan and profile for IWL (acid sewer) from TA-3 to TA-45.

B. History of the Industrial Waste Line

Research and development operations at LASL have generated radioactively contaminated liquid industrial wastes since 1943. The untreated wastes from TA-1* were initially discharged into Pueblo Canyon (Fig. 4). Starting in 1952, a treatment plant (TA-45) utilizing precipitation/flocculation operations was placed in service to process wastes from TA-1. By late 1953 wastes from the newer laboratory complex (TA-3) south of Los Alamos Canyon and the Health Research Laboratory (TA-43) were also piped to TA-45. In 1958, wastes from TA-48, a newly constructed radiochemistry site south of Los Alamos Canyon, entered the system. Wastes from TA-3 and TA-48 flowed first to a waste neutralization/storage station designated TA-3-700 (Fig, 2), which was equipped with a motorized, remotely controlled discharge valve. A plant operator at TA-45 controlled the flow from TA-3 and TA-48 with the valve at TA-3-700.

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*TA-1 *was where most facilities were built at* Los Alamos *during* World War II *for research and* development on nuclear fission weapons. It subsequently served the same capacity for the nuclear fusion weapons work.

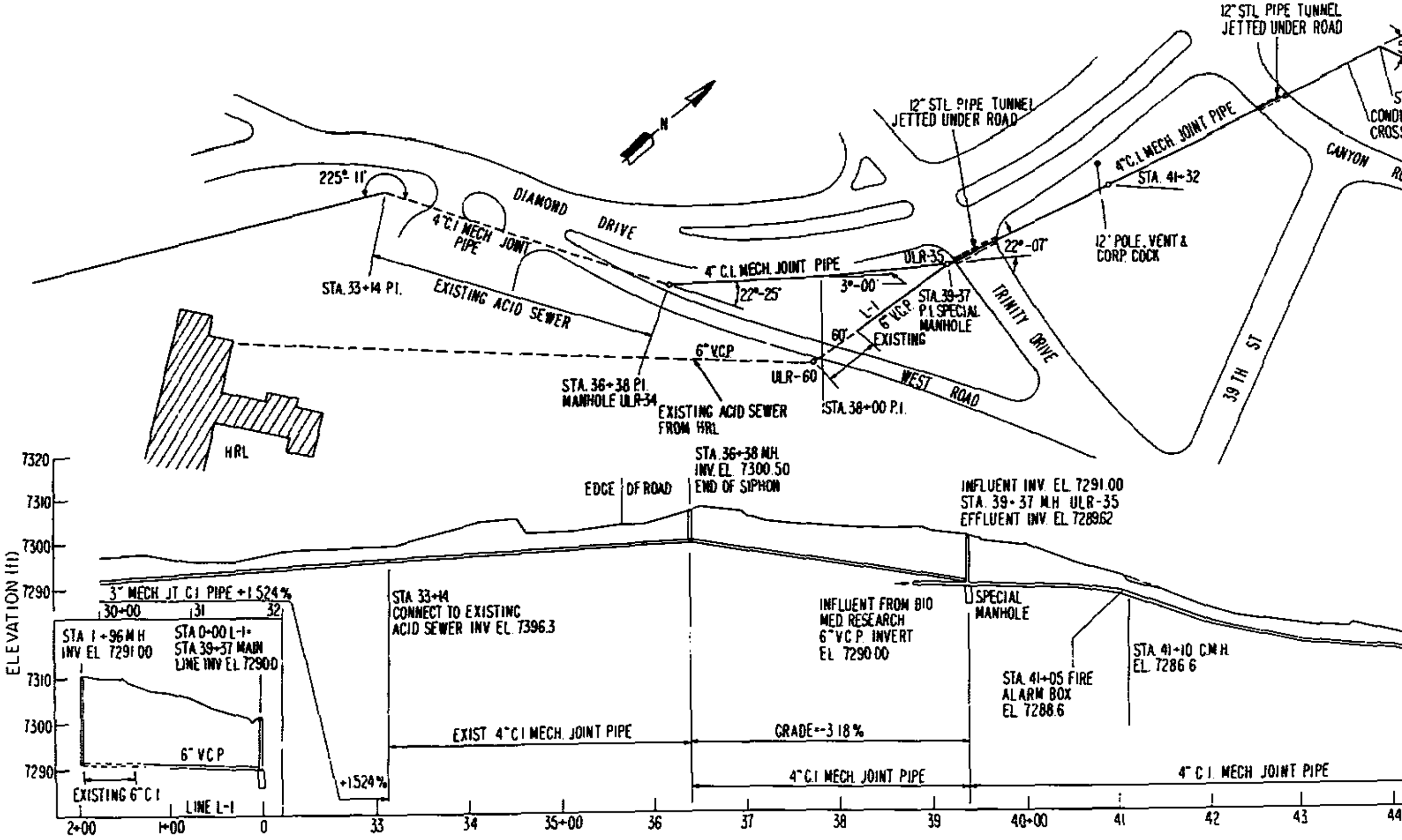


Fig. 3.
Plan and profile for IWL (acid sewer) from TA-3 to TA-45.

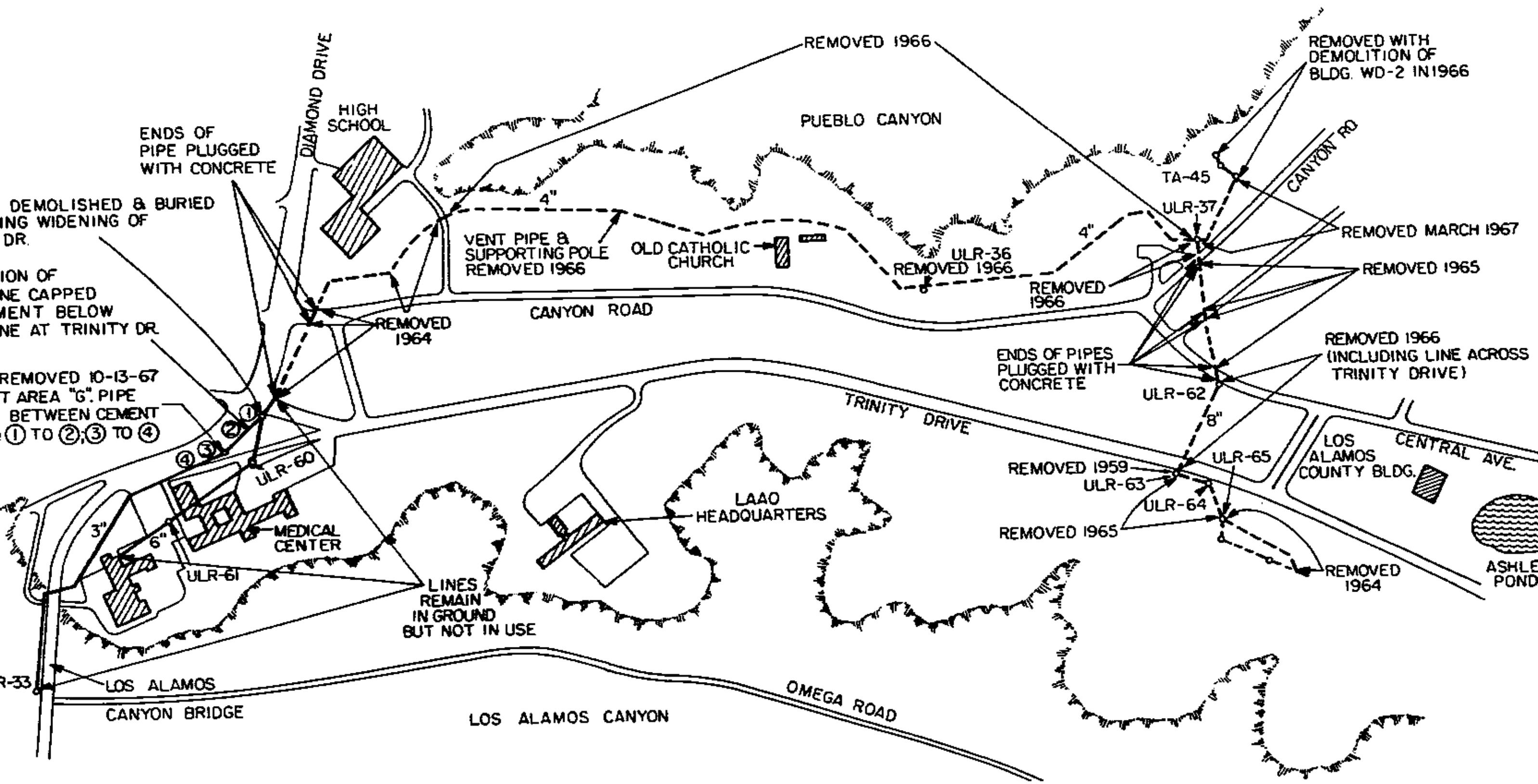

REMOVED 1966
REMOVED WITH DEMOLITION OF BLDG. WD-2 IN1966
PUEBLO CANYON
HIGH SCHOOL
DIAMOND DRIVE
ENDS OF PIPE PLUGGED WITH CONCRETE
DEMOLISHED & BURIED
ING WIDENING OF
DR.
ION OF
NE CAPPED
MENT BELOW
NE AT TRINITY DR.
REMOVED 10-13-67
T AREA "G". PIPE
BETWEEN CEMENT
① TO ②; ③ TO ④
4"
VENT PIPE & SUPPORTING POLE REMOVED 1966
OLD CATHOLIC CHURCH
ULR-36
REMOVED 1966
TA-45
ULR-37
CANYON RD.
REMOVED MARCH 1967
REMOVED 1965
REMOVED 1966
REMOVED 1964
CANYON ROAD
ENDS OF PIPES PLUGGED WITH CONCRETE
REMOVED 1966 (INCLUDING LINE ACROSS TRINITY DRIVE)
ULR-62
8"
TRINITY DRIVE
LOS ALAMOS COUNTY BLDG.
CENTRAL AVE.
REMOVED 1959
ULR-63
ULR-65
ULR-64
REMOVED 1965
REMOVED 1964
ASHLE
POND
ULR-60
MEDICAL CENTER
3"
6"
ULR-61
LINES REMAIN IN GROUND BUT NOT IN USE
LAAO HEADQUARTERS
R-33
LOS ALAMOS CANYON BRIDGE
LOS ALAMOS CANYON
OMEGA ROAD

Fig. 4

serving TA-43 entered the system (Fig. 4). The first wastes from TA-3 were discharged in June and from TA-43 in September of 1953.[1] TA-3 waste in 1953 was very dilute and a practice was adopted of monitoring the waste stored at TA-3-700. If the radioactivity would cause the two-week effluent average at TA-45 to exceed 330 dis/min-ℓ of gross-alpha activity (the maximum permissible concentration at that time for the release of gross-alpha activity to the environment[2]), the waste was routed through a diversion manhole for treatment at TA-45. If this level was not exceeded, the waste was diverted directly to Pueblo Canyon. In July 1953, ~3% of the TA-3 waste was diverted to the plant; by the end of December 1953, 70% of the waste was being diverted. Some data on plant operations for December 1953 are given in Table I. This waste was a composite of discharges from TA-1, TA-3, and TA-43.

In 1953 the highest levels of alpha activity were recorded in July. Gross-alpha activity in July averaged 46 000 dis/min-ℓ with a maximum day sample of 1.04×10^6 dis/min-ℓ. Most of this was recorded as plutonium. The influent plutonium totaled 557 mg.

The TA-3, TA-43 and TA-48 connections to TA-45 remained in service until mid-1963. Because small quantities of very dilute waste were released from TA-43, TA-43 waste lines were disconnected from the IWL system and reconnected within the building to the sanitary system.

On July 27, 1963, the IWL between TA-3-700 and TA-45 was abandoned and a new pumping station that had been added to SM-700 was placed in operation to redirect the wastes to the new treatment plant at TA-50. TA-45 continued to treat waste from TA-1 until May 26, 1964 [after this the low-level wastes from TA-1 (because of the cleanup of Sigma Building) were diverted, without treatment, to Pueblo Canyon]. By November the sludge had been removed and equipment was being moved out of TA-45. Building demolition was completed in the last quarter of 1966.[3] During the 10-year period that the IWL was in service, flows from the area south of Los

TABLE I

OPERATING DATA, TA-45
DECEMBER 1953

	Av Day	Min Day	Max Day
Flow to plant (1000 ℓ/day)	89.0*	63.2	154.4
Total treated (1000 ℓ/day)	110.5*	51.9	135.1
Influent gross alpha (1000 dis/min-ℓ)	2.2	0.2	14.6
Influent Pu (1000 dis/min-ℓ)	2.2	0.2	14.6
Influent (mg Pu/day)	1.5	0.1	9.9
Effluent gross alpha (dis/min-ℓ)	174	0	1892
Effluent Pu (dis/min-ℓ)	38	0	124
Influent Na (mg/ℓ)	42	30	51
Influent Ca (mg/ℓ)	12	11	14
Influent F (mg/ℓ)	3	2	4
Influent NO_3-N (mg/ℓ)	64	8	140
Influent pH	7.8	3.4	8.4

*Average flows to the plant are less than the amount treated because fluids are added in the treatment process.

Data on the chemical composition of influent waste to TA-45 are incomplete. However, from January 1960 through June 1964, information on analyses of weekly composite influent and effluent samples is available with respect to pH, conductivity, Na, alkalinity (using both phenolphthalein and methyl orange methods), Cl, total hardness, Ca, Mg, NH_3-N, NO_3-N, F, and CN. Table III provides some representative information.

C. Previous IWL Removal Efforts

Removal of the abandoned IWL connecting TA-1, TA-3, TA-43, and TA-48 to TA-45 began in 1964 (Figs. 2-4). IWL sections were first removed in areas where Los Alamos County or private construction activities might first occur. Figure 4 shows the IWL sections that were removed and when they were removed. In 1964 the IWL along Diamond Drive and at TA-1 was taken out. IWL sections under the intersections of Diamond Drive and Trinity Drive and of Diamond Drive and Canyon Road were left in place so newly paved streets would not have to be torn up (Fig. 4).

During 1965, the IWL from TA-1 to TA-45 was removed. Portions of the IWL under paved roads (Central Avenue, Rose Street, and Canyon Road) were left in place, again so paved streets would not have to be torn up. In 1966 and 1967, most portions of the IWL on private land between TA-3 and TA-45 were removed.

TABLE II

WASTE CHARACTERISTICS (RADIOACTIVITY) 1954 - 1963

		TA 1/3/43/48 Gross Alpha (1000 dis/min-ℓ)			
Year	TA 3/43/48 Flow (10^6 Liters)	Monthly Average	Monthly Maximum	Monthly Minimum	Pu (mg)
1954	12.7	9.8	20.8	2.5	2604
1955	13.6	4.8	8.8	2.0	1032
1956	14.3	4.2	7.4	1.2	794
1957	17.0	7.2	21.0	3.4	1429
1958	16.9	9.4	17.5	3.6	1567
1959	26.7[a]	14.2	26.0	7.0	3577
1960	41.1[b]	13.3	71.6	9.2	5296
1961	52.9	9.8	31.4	10.8	5686
1962	64.1	7.4	26.4	7.8	4906
1963	29.7[c]	14.7	19.6	11.4	2142

[a]*Transfer of operations from TA-1 to TA-3 resulted in a marked decrease in flow from TA-1 and increase from TA-3 for July and following. For December, TA-1 flow was 340 000 ℓ and further recording of separate TA-1/TA-3 influent flows was discontinued.*

[b]For 1960 and beyond, the flow indicated is a total of that from TA-1, TA-3, TA-43, and TA-48.

[c]After June 27, 1963, all TA-3 and TA-48 waste was pumped to TA-50. This figure is a total of the TA-1, TA-3, TA-43, and TA-48 waste to TA-45 from Jan 1 to June 27, 1963. Activity figures are

1960 - 1963

	1960	1961	1962	1963*
pH	7.5	8.4	8.8	8.7
Na (mg/ℓ)	114	118	120	97
Ca (mg/ℓ	15	12	13	13
NO_3-N (mg/ℓ)	19	12	10	6
F (mg/ℓ)	4.8	3.1	2.6	2.2

*Through June

The same general approach was used for all these removal efforts. A backhoe exposed the IWL and then personnel entered the trenches to break the pipe into manageable lengths. Pieces of pipe were then loaded into trucks. Finally, tarpaulins were tied down over the loads for the trip to the radioactive waste disposal area. Monitoring of trucks before returning for the next load ensured against carrying contaminated material from the disposal area. Uncontaminated soil removed during excavation was used to backfill the trench; contaminated soil was sent to the disposal area.

All workers wore protective clothing through the operations. For some work in manholes, supplied-air suits were used. Air sampling during the operations in the immediate vicinity of the line removal and in residential areas as much as 2 km distant indicated no significant dispersal of contamination from removal operations.

A portable alpha radiation instrument (a Pee-Wee) with an air proportional dectector and a 60 cm^2 window was used to detect alpha contamination. Its lower detection limit was approximately 100 counts/min-60 cm^2, which applies to thin, uniform, dry, alpha contamination spread over a flat, non-porous surface. Any departure from these ideal conditions significantly raises the detection limit. Contamination levels up to 3000 counts/min-60 cm^2 gross-alpha were measured on the pipe's inside surfaces. Most measurements of the inside of the pipe were considerably less than this. No radiochemical analyses were done on any samples.

As stated earlier, early in 1977 the Los Alamos County Council decided to improve the intersection of Diamond and Trinity Drives (Fig. 3). DOE, LASL administration, and the Los Alamos County Council agreed this was an opportune time to remove the IWL in the vicinity of the intersection, so the 11-week project started in March 1977. Details are given in the following sections.

II. OPERATIONAL METHODS

A. Radiological Survey Methods

Surveys of all excavations were made with a phoswich[4] and a micro-R meter (Appendix D) to ensure no major contamination was present. This was followed by soil sampling, which included sampling at all locations where the pipe was cut for removal, all pipe joints, and all places where the line had been broken previously. Samples were analyzed with a ZnS alpha scintillation detector system[4] located in a field trailer near the operations. The ZnS system has a detection limit of ~25 pCi/g above natural alpha background in soil for a 5 min count.

material was examined after it had been excavated from the trench.

Soil was scooped from under the 10 cm diam cast iron IWL pipe (Fig. 6) to allow placement of plastic bags (one bag inside a second bag) under the pipe. These bags collected any liquid and/or

Fig. 5.
Backhoe used to excavate a trench down to buried IWL.

Fig. 6.
Soil is scooped from under 10 cm diameter cast iron IWL to allow placement of plastic ba
(one bag inside a second bag) under the pipe.

and adhesive tape (Figs. 8-9).

Any soil wetted with liquid from the pipe was sent in sealed plastic bags to the radioactive waste disposal site. Monitoring of the sealed pipe with a phoswich determined if any activity were on the pipe's exterior (Fig. 10). A soil sample was collected under the cut (Fig. 11). Each joint underwent visual inspection and monitoring to determine if any leaks had occurred in the past. The pipe section was then removed from the trench (Fig. 12) and placed into dump trucks for shipment to the disposal site. The dump truck beds were lined with plastic (Fig. 13) and a custom-made tarpaulin covered the load while in transit to the waste disposal area (Fig. 14). The trucks were monitored before returning for their next load to ensure against carrying contaminated material from the disposal area.

After the pipe was removed, the trench was again monitored with a field phoswich. If contamination were detected, the area was decontaminated to gross-alpha levels ≤25 pCi/g of gross-alpha activity by trucking the contaminated soil to the disposal area. For small amounts of contaminated soil, the material was shoveled into plastic bags and the sealed bags sent to the disposal area. Uncontaminated soil was used to backfill the trench.

Lowboy trailers were used to transport concrete manholes to the disposal area. All ports in the structures were sealed with concrete prior to removal. Prior to transport, the entire manhole was wrapped in plastic. Health physics personnel and the Los Alamos police escorted the lowboys to the waste disposal site. On the highway, periodic inspection of the lowboys and structures was performed to ensure that there was no spillage.

C. Determination of Extent of Decontamination Required

The basic premise of the decontamination operations was that all contamination found was removed to the lowest levels found practicable to attain. Excavation in a given area proceeded until no further contamination was detectable by the field phoswich (the most sensitive portable device). Soil samples were then collected and analyzed for gross-alpha activity. If measurable activity (>25 pCi/g) remained, additional excavation removed more material in an iterative process; this continued until no further contamination was identified or until a decision was made that residual contamination was as low as could practicably be achieved.

A determination that decontamination was complete involved consideration of several factors. Some of the most important ones included location of the contaminant and cost of further efforts to reduce levels in terms of time, money, or immediate physical hazards to personnel.

In practice, the LASL Health Division personnel overseeing the field operations used professional judgement to weigh these and other relevant factors in directing the day-to-day field operations. At regular intervals the LASL personnel presented the data and made recommendations on decontamination progress to the Operations personnel of DOE's Los Alamos Area Office (LAAO). The LAAO personnel reviewed the information and made final decisions that decontamination had or had not proceeded as far as practicable. The figures giving final soil sample results (Appendix B) reflect the conditions considered to meet these criteria.

D. Related Support Operations

1. Occupational Health Physics. Through all decontamination operations, health physics monitoring for protection of workers was conducted and suitable precautions were taken to ensure no workers were unnecessarily exposed to ionizing radiation. Anticontamination clothing,

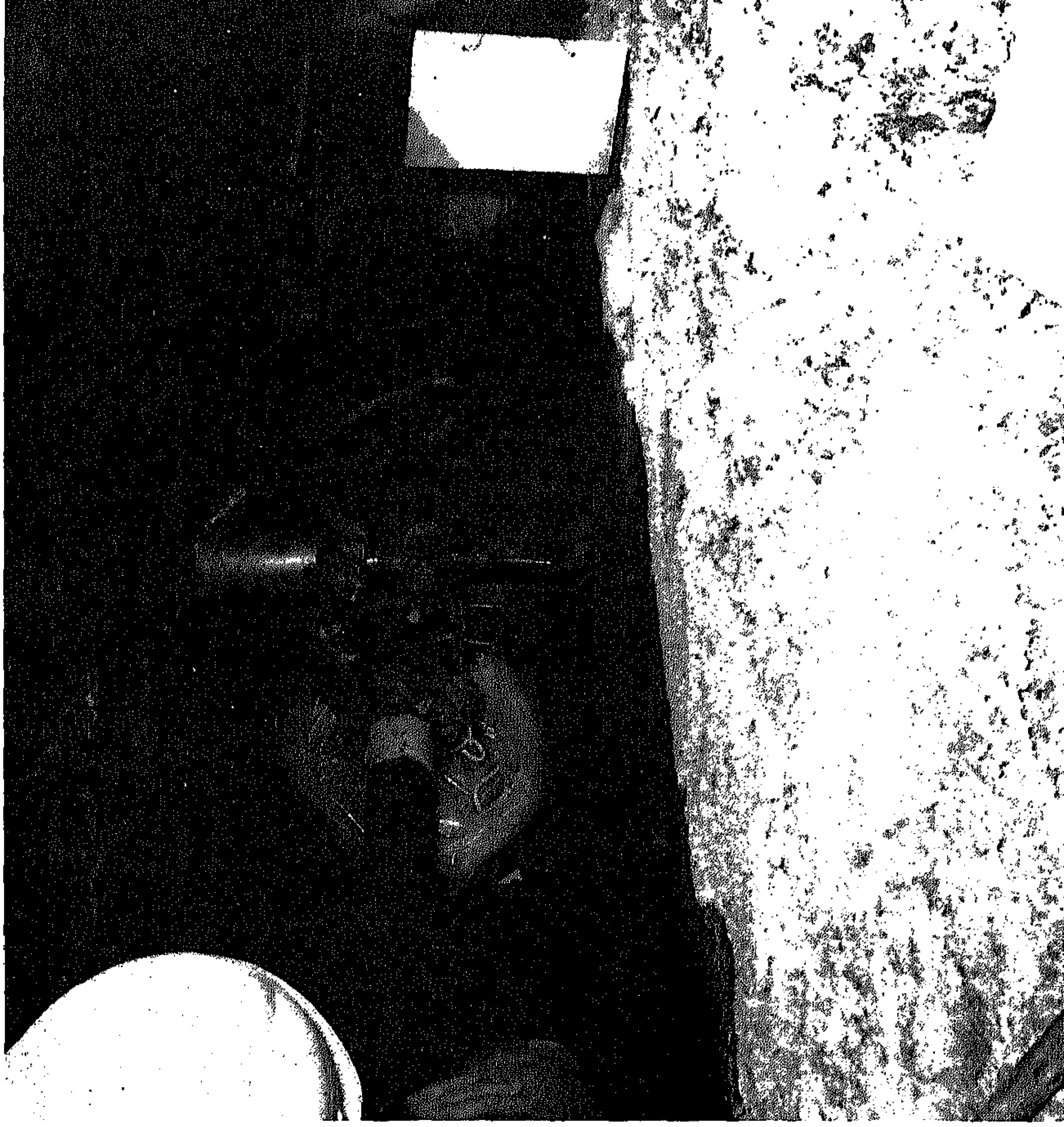


Fig. 7.
IWL is cut with a hydraulic press.

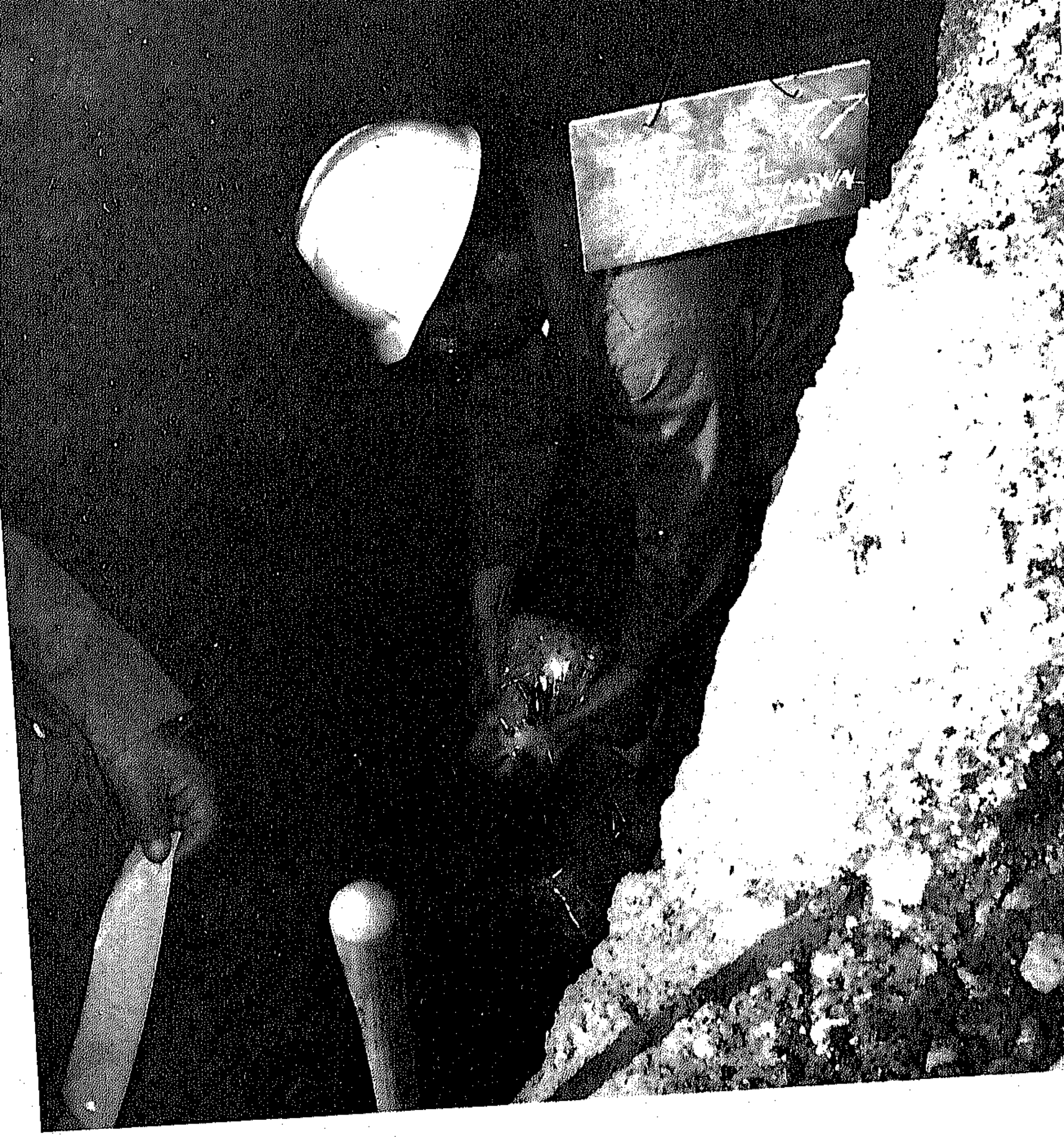


Fig. 8.
Ends of cut IWL are sealed with plastic bags and adhesive tape.

Fig. 9

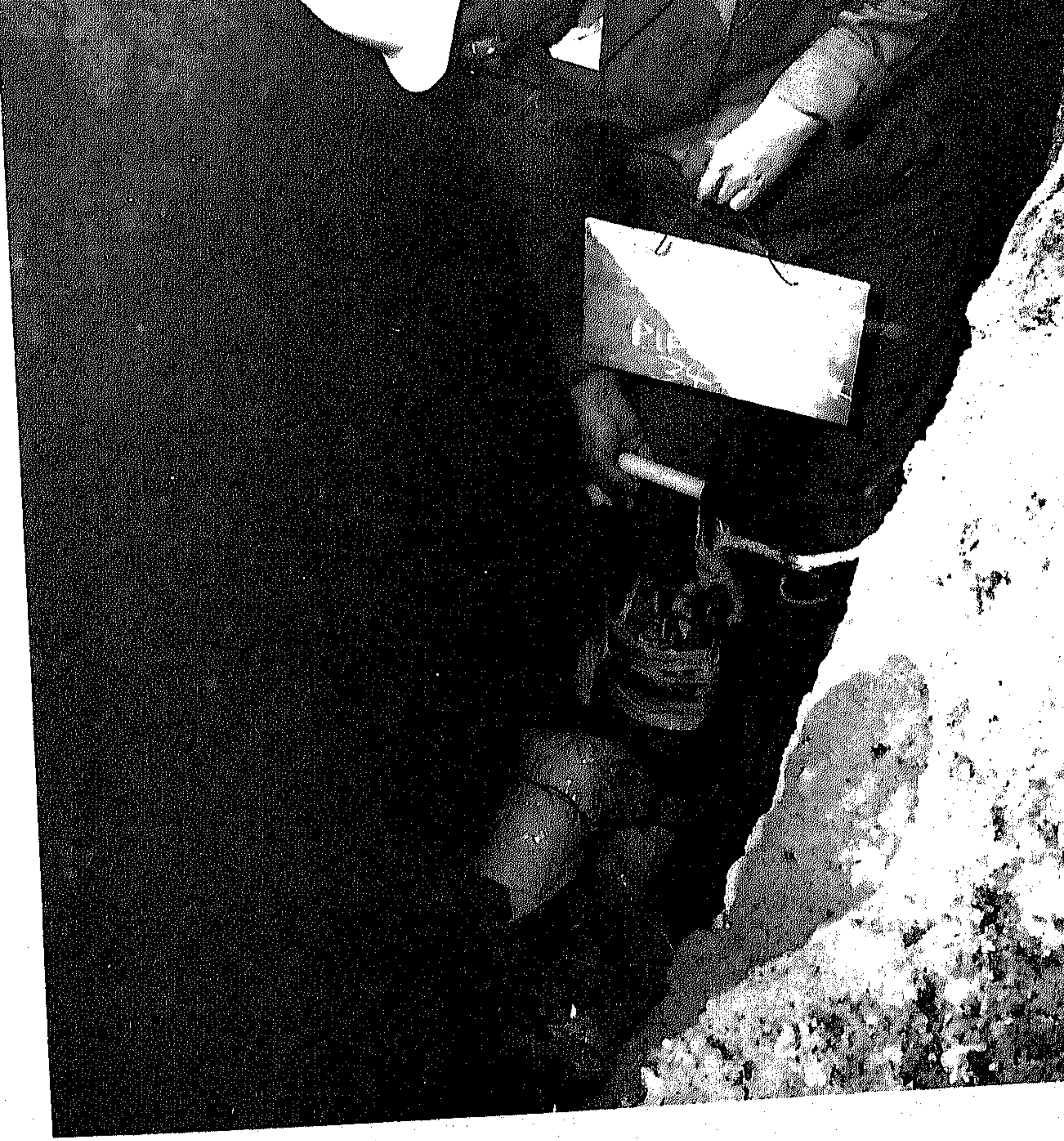


Fig. 10.
Sealed IWL is monitored with a phoswich to determine if any activity is on the pipe's exterior.

Fig. 11.
Soil sample is collected under the cut in the IWL.

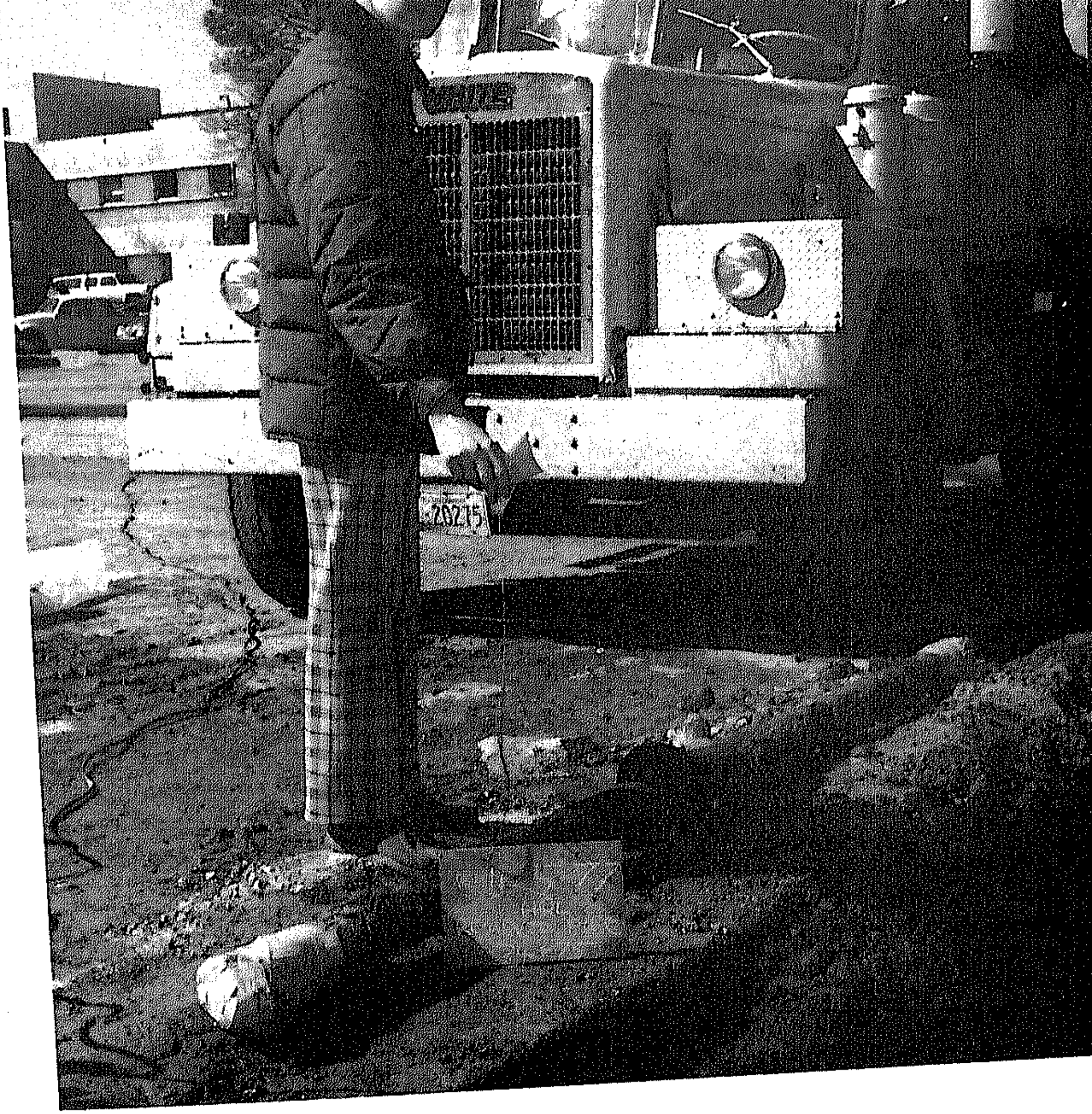


Fig. 12.
Section of removed IWL.

Fig. 13.
Dump truck beds are lined with plastic to prevent soil spillage.

including coveralls, gloves, footwear, and head coverings, was worn by all workers in contamination removal operations. A full face mask with a particulate filter, and vinyl coveralls, were worn by each person working inside a manhole (Fig. 15).

Personnel dosimeters (film badges) were worn by all workers. Film badge results from an 11 week period for the 23 people most active in the project indicate four positive readings (>10 millirem) of 69 badges analyzed. The maximum total exposure (for one individual for one month) was 30 millirem. Because all workers and health physics monitors worked at several locations during this time, it was not possible to identify any contribution to this exposure from work on the IWL.

Air sampling in the immediate vicinity of decontamination operations was performed throughout the workday and the air filters were analyzed daily. Forty samples were taken and none showed any long-lived gross-alpha or gross-beta levels above instrumental backgrounds of 0.26 counts/min (0.74 dis/min equivalent) gross-alpha and 2.9 counts/min (5.6 dis/min

Fig. 14.
A tarpaulin covers a load of contaminated soil.

equivalent) gross-beta. With the sampling methods used, these lower limits of detection correspond to 0.7% of the Radioactivity Concentration Guide (RCG) for ^{239}Pu and 0.0035% of the RCG for unknown gross-beta activity as specified by Manual Chapter 0524.[5]

All personnel working around contamination were also required to submit urine for plutonium analysis; a total of 23 urinanalyses were performed and all results indicated no detectable exposure. These radiation safety measures were taken to protect working personnel and the public from unanticipated, but possible, encounters with high levels of contamination.

2. **Safety.** Excavation collapse, traffic hazards, public on the job site, and damage to underground utilities were the main safety concerns identified and planned for prior to project start-up.

a. Excavation Collapse. Since excavations were entirely in previously excavated soil with indeterminate grades of backfill, shoring in accordance with the Occupational Health and Safety Administration regulations[6] was required during the entire project. The Zia Company (the LASL support contractor) devised a shoring system used throughout the project (Fig. 16). The shoring proved itself on May 11, 1977, when a section of the soil, weighing about 1000 kg, collapsed and

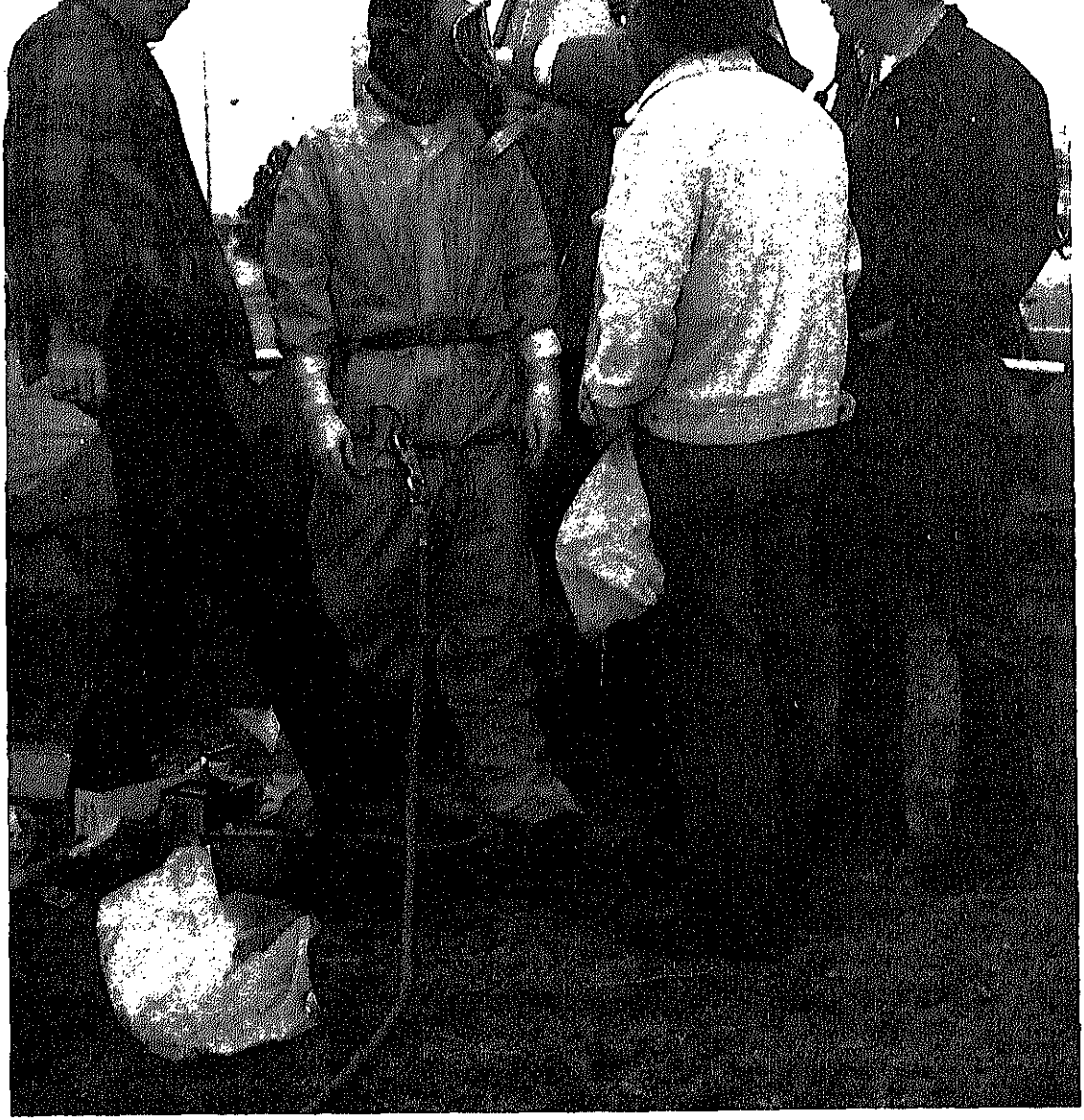


Fig. 15.
A full face mask with a particulate filter and vinyl coveralls are worn by each person working inside a manhole.

was restrained by the shoring. Three workers were in the trench at that time, but none were hurt. In several places, it was advantageous to remove about a meter of soil prior to trenching to eliminate or reduce the need for shoring. A backhoe removed pipe directly along the deepest section of the trench, eliminating the need for personnel entry into the trench.

Fig. 16.
Shoring system used throughout the project.

b. Traffic Control. Traffic control plans developed and implemented for several phases of the project included barricades, signs, and flagmen to assist trucks in entering and exiting the construction area (Fig. 17). Two minor accidents occurred. The first involved an intoxicated driver driving an auto into one of the barricades. The second happened inside the construction zone and occurred when an unattended private vehicle rolled into a parked government vehicle. There were no injuries in either accident.

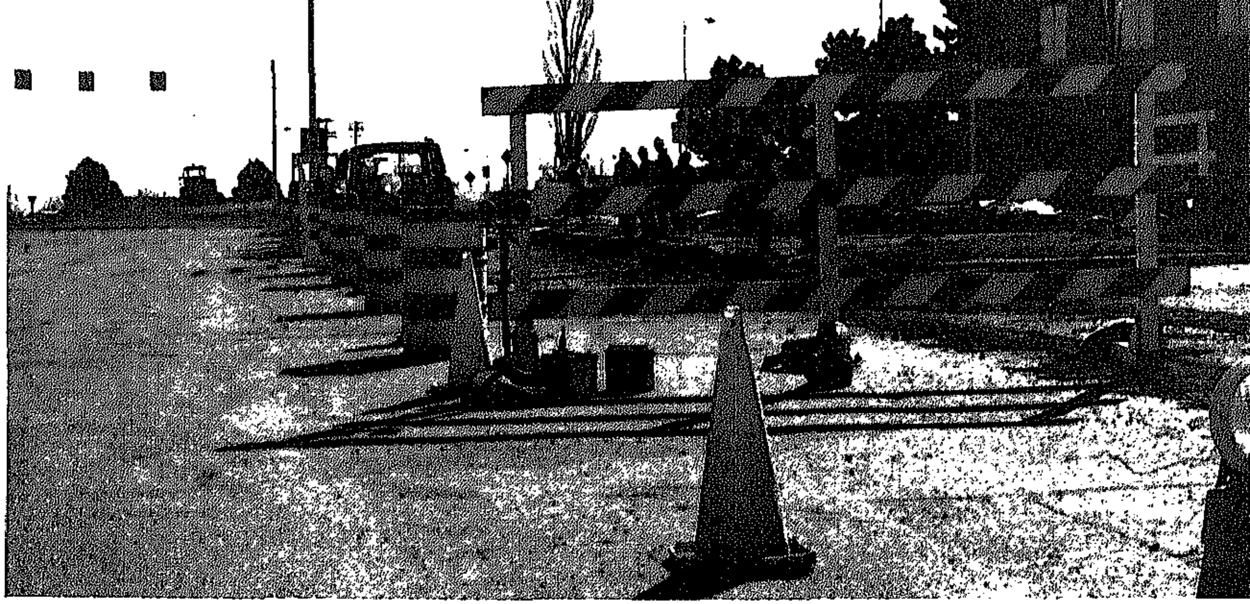


Fig. 17.
Traffic control barricades assist trucks in entering and exiting the construction area.

c. *Public on the Job Site.* To prevent injury to the public, a variety of control measures were employed, including backfilling of excavations, covering open trenches, fencing, and stationing of watchmen. No injury to the public was reported.

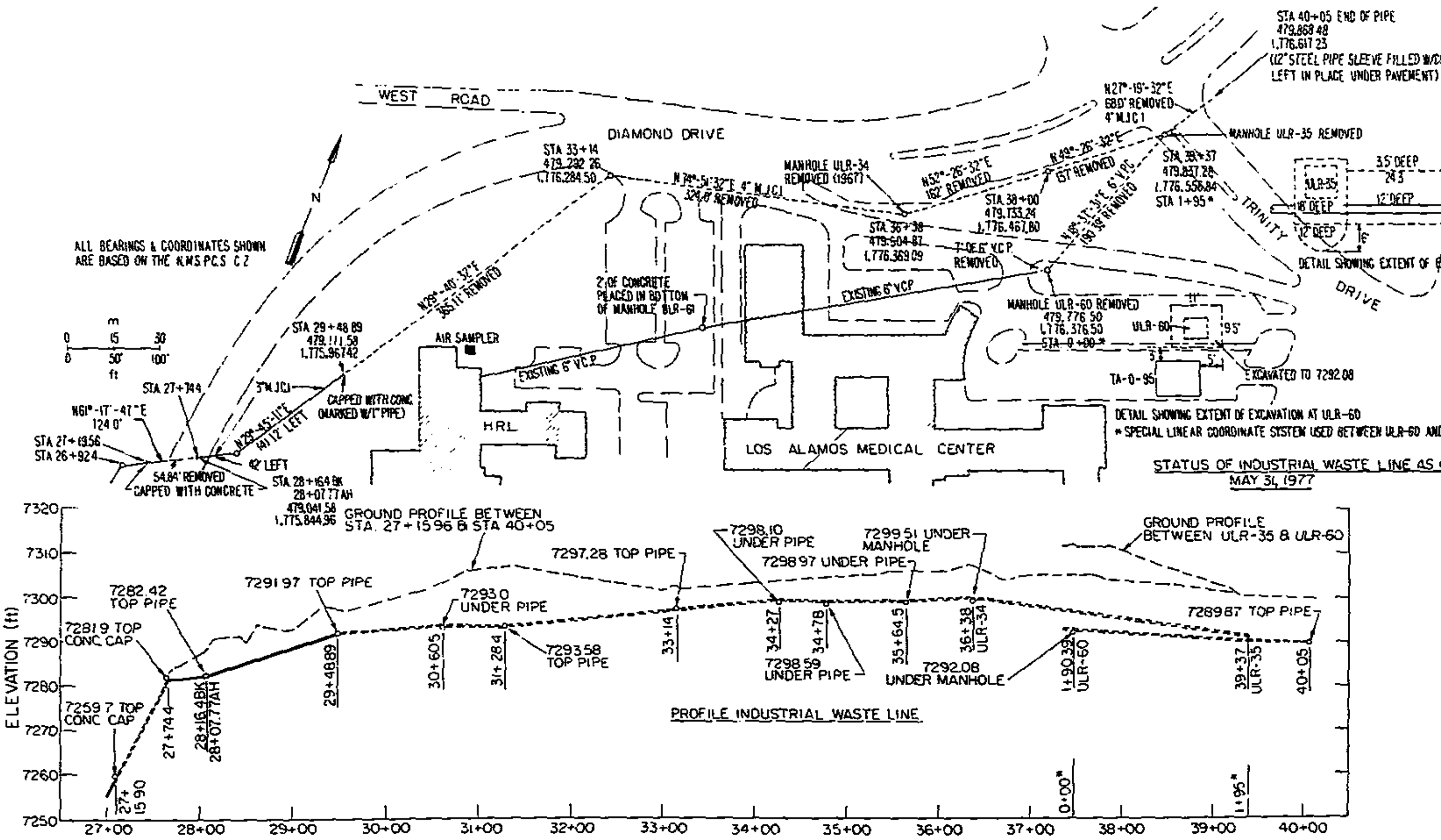
d. *Underground Utilities.* A Zia policy that known underground utilities must be exposed by hand was followed. A 15-cm diam water main was broken through, causing a one day delay. In this case the line had been exposed and staked, but covered again to accommodate the backhoe. The line broke when hit by the backhoe because of a misinterpretation of the staking.

3. Environmental Air Sampling

Continuous air sampling stations were established at two locations (the Episcopal Church and the HRL) near the major decontamination operations (Fig. 18). These were at the nearest areas frequented by the general public. Measurements at these stations included gross-alpha and beta analyses. In summary, the gross-alpha and beta were not significantly different from similar measurements from the environmental air sampling network (Appendix C).

4. Level of Effort

The equipment and manpower charged to this project are detailed in Appendix A.


STATUS OF INDUSTRIAL WASTE LINE AS OF
MAY 31, 1977
WEST ROAD
DIAMOND DRIVE
TRINITY DRIVE
LOS ALAMOS MEDICAL CENTER
HRL
AIR SAMPLER
TA-0-95
ALL BEARINGS & COORDINATES SHOWN ARE BASED ON THE N.M.S.P.C.S. C.Z.
N
STA 40+05 END OF PIPE
479,868.48
1,776,617.23
(12" STEEL PIPE SLEEVE FILLED W/C
LEFT IN PLACE UNDER PAVEMENT)
N27°-19'-32"E
68.0' REMOVED
4" M.J.C.I.
MANHOLE ULR-35 REMOVED
STA 39+37
479,837.28
1,776,556.84
STA 1+95*
N49°-26'-32"E
151' REMOVED
N52°-26'-32"E
162' REMOVED
MANHOLE ULR-34
REMOVED (1967)
STA 38+00
479,733.24
1,776,467.80
STA 36+38
479,504.87
1,776,369.09
7'OF 6" V.C.P.
REMOVED
MANHOLE ULR-60 REMOVED
479,776.50
1,776,376.50
STA 0+00*
EXCAVATED TO 7292.08
DETAIL SHOWING EXTENT OF EXCAVATION AT ULR-60
* SPECIAL LINEAR COORDINATE SYSTEM USED BETWEEN ULR-60 AND
DETAIL SHOWING EXTENT OF
3.5' DEEP
24.3
12' DEEP
16' DEEP
EXISTING 6" VCP
N74°-51'-32"E 4" M.J.C.I.
324.0' REMOVED
STA 33+14
479,292.26
1,776,284.50
2' OF CONCRETE
PLACED IN BOTTOM
OF MANHOLE ULR-61
N29°-40'-32"E
365.11' REMOVED
STA 29+48.89
479,111.58
1,775,967.42
CAPPED WITH CONC.
(MARKED W/1" PIPE)
3" M.J.C.I.
N29°-45'-11"E
141.12' LEFT
42' LEFT
STA 27+74.4
N61°-17'-47"E
124.0'
STA 27+19.56
STA 26+92.4
54.84' REMOVED
CAPPED WITH CONCRETE
STA 28+16.4 BK
28+07.77 AH
479,041.58
1,775,844.96
m 0 15 30
ft 0 50' 100'
PROFILE INDUSTRIAL WASTE LINE
ELEVATION (ft)
GROUND PROFILE BETWEEN
STA. 27+15.96 & STA 40+05
GROUND PROFILE
BETWEEN ULR-35 & ULR-60
7282.42
TOP PIPE
7281.9 TOP
CONC CAP
7259.7 TOP
CONC CAP
7291.97 TOP PIPE
7293.0
UNDER PIPE
7293.58
TOP PIPE
7297.28 TOP PIPE
7298.10
UNDER PIPE
7298.97 UNDER PIPE
7298.59
UNDER PIPE
7299.51 UNDER
MANHOLE
7292.08
UNDER MANHOLE
7289.87 TOP PIPE
27+15.90
27+74.4
28+16.4BK
28+07.77AH
29+48.89
30+60.5
31+28.4
33+14
34+27
34+78
35+64.5
36+38
ULR-34
1+90.39
ULR-60
39+37
ULR-35
40+05
0+00*
1+95*

This section describes in detail the results of the various survey and sampling efforts, as well as the major findings and actions taken to achieve decontamination. The New Mexico State Plane Coordinate System [NMSPCS, part of the U. S. Coast and Geodetic Fundamental Survey Control System (Fig. 18)] was the basis of all survey calculations on this project, while the LASL Cartesian Coordinate System† was used to document structure locations. A linear coordinate system originating at acid sewer manhole SM-708 (Fig. 2) was used to document sample locations along the main IWL trunk. The coordinates are in linear feet (e.g., 35+10 = 3510 ft). Sample locations on a branch of the IWL between manholes URL-35 and ULR-60 were determined with another linear coordinate system starting with Station 00+00* (0 ft) at ULR-60 and ending with Station 01+95* (195 ft) at ULR-35 (Fig. 18). Figure 18 shows those portions of the IWL removed during this project. Appendix B documents all soil sample results. (Fifty-two of approximately 300 soil samples taken during the project had gross-alpha activity >25 pCi/g. Only one post-decontamination soil sample had gross-alpha activity >25 pCi/g and its value was 40 pCi/g.) Appendix E shows normal background northern New Mexico soil concentrations of some radionuclides.

B. Cast Iron IWL Pipe

The westernmost excavation as part of this project occurred at point 29+49 (Fig. 18). After breaking and removing the pipe extending to the east, the crew sealed the end left in the ground with a concrete plug and marked the location at the surface with a 2.5-cm diam pipe (Fig. 19). Removal of pipe from point 29+49 to point 35+64 required 61 breaks. Minor contamination (<200 pCi/g gross-alpha) occurred at nine breaks or joints and two other locations. Excavation of small quantities of soil removed all measurable gross-alpha contamination so that all final samples showed ≤25 pCi/g gross-alpha.

At point 35+64 a concrete plug emplaced during the 1967 excavations sealed the end of the pipe. However, some contamination existed beneath the broken underside of the pipe. Gross-alpha measurements showed a maximum of 170 pCi/g, and subsequent radiochemical analyses showed 0.85±0.03 pCi/g of ^{239}Pu and 0.019 ± 0.003 pCi/g ^{238}Pu. (Surface soils in northern New Mexico contain 0.01 to 0.04 pCi/g ^{239}Pu from worldwide fallout; see Appendix E.) Excavation reached a depth of 2 m below the pipe location before removing all detectable (≤25 pCi/g gross-alpha) contamination (Fig. 18 and Appendix E).

The trench was clean and free of pipe between 35+64 and 36+50. Contamination (8000 counts/min maximum on the phoswich) was found at the location of the previously (1967) excavated ULR-34 manhole (36+38). Decontamination resulted in ≤25 pCi/g of gross-alpha activity in all final samples.

At 36+50 the concrete plug sealing the pipe end came loose during excavation. Although nothing was detected by the phoswich, the soil surrounding the plug was sent to the disposal area. No gross-alpha activity >25 pCi/g was detected outside the pipe, but 1500 pCi/g gross-alpha was found inside the pipe. The pipe terminated again at 36+65 and had been sealed with a concrete plug that was loose. The soil around the plug was sent to the waste disposal area, so gross-alpha activity in the final samples was ≤25 pCi/g.

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†System is based on English units of measurement and is independent of the NMSPCS. The major coordinate markers shown in Fig. 18 and in Appendix B are at 50 ft intervals.)

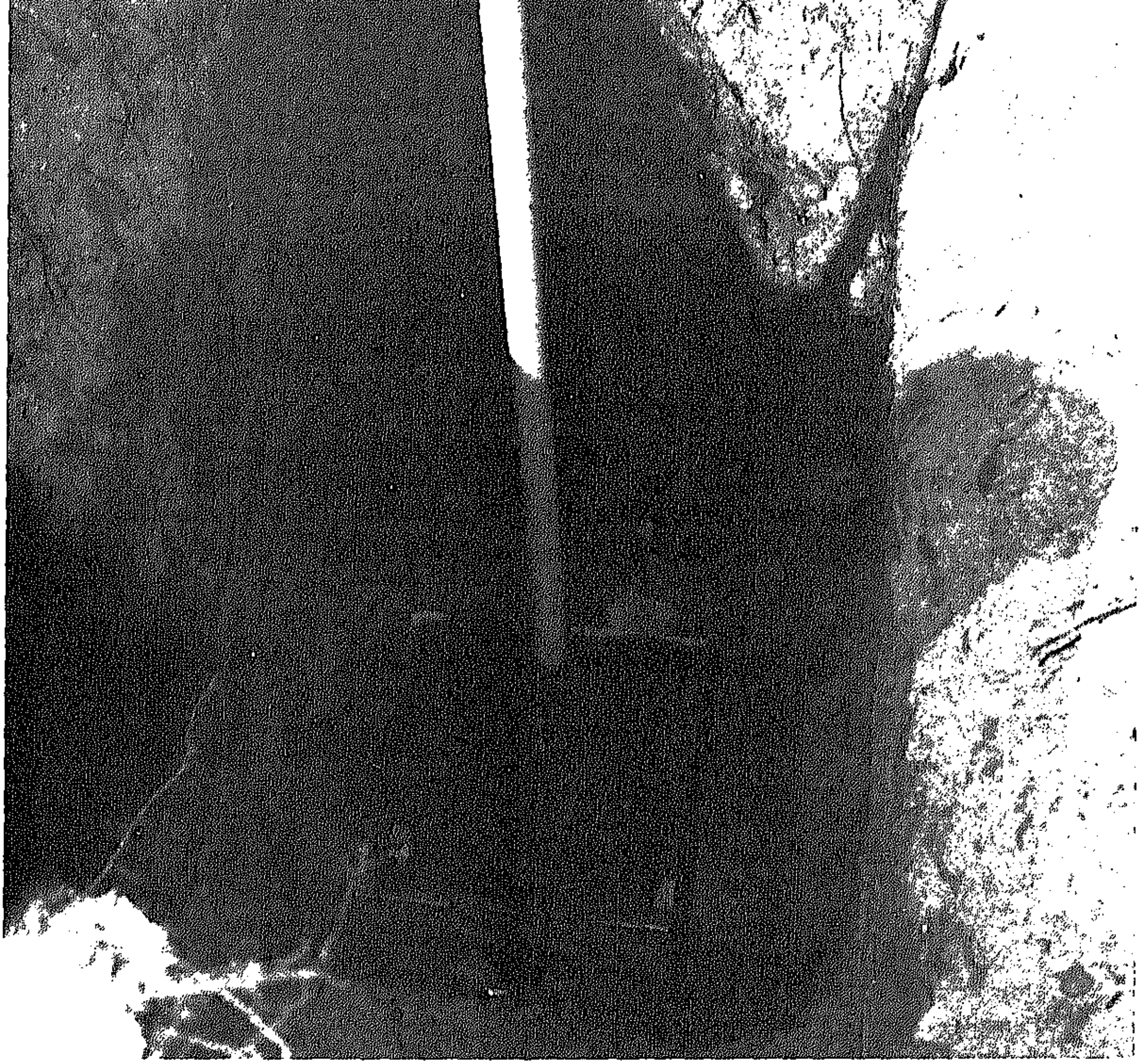

Fig. 19.
IWL end at 29+49 is sealed with concrete.

The empty trench from 36+70 to 37+14 was excavated, monitored, and the soil sampled for gross-alpha analysis. At 37+14 the pipe was located again with a concrete plug over its end; the plug was loose so surrounding soil was sent to the disposal area. The pipe was removed to manhole ULR-35 (39+37) where gross-alpha activity was found. Sections of pipe were missing from 38+30 to 38+40 and from 38+50 to 38+85.

this structure on this project (Figs. 20 and 21), contamination >100 000 counts/min on the phoswich and 5000 counts/min gross alpha on a survey meter were found in the soil on the northern and southern sides at the level of the inlet and outlet ports. The contamination originated from inadequately sealed ports (Fig. 22). A sample near the port that had 1400 pCi/g of gross-alpha activity on the ZnS system, was analyzed radiochemically and the isotopes identified were ^{238}Pu (20±1 pCi/g), ^{239}Pu (760±30 pCi/g), ^{241}Am (200±4 pCi/g), ^{137}Cs (50±3 pCi/g), ^{60}Co, and ^{236}U. Holes were drilled into the top of inlet and outlet pipes prior to cutting the pipes to determine if liquid was present. There was none. The manhole was removed and taken to the waste disposal area (Figs. 23 and 24) and the excavation decontaminated to as low as practicable.

D. Casing Under Trinity Drive

The outlet pipe exiting ULR-35 ran north through a 30-cm diam casing under Trinity Drive (Fig. 25). The pipe was found with a loose concrete seal over its end at 40+00. Some gross-alpha contamination (~1300 pCi/g) was found on the northern edge of the casing. Soil was removed until the area was decontaminated to ≤25 pCi/g of gross-alpha activity. The pipe running through the casing was removed and the casing cleaned out (Fig. 26). Dust problems during cleaning were eliminated by filtration of the casing air through a high efficiency particulate filter. A thin layer (<5 mm thick) of rust too difficult to remove was left in the middle of the casing. A gross-alpha count of the rust was 300 pCi/60 cm^2. This condition was determined to be as low as practicable so the casing was grouted with concrete and left in place.

E. Clay IWL Pipe

The IWL between manholes ULR-35 and ULR-60 (Fig. 18) served TA-43 only and consisted of a 15 cm diam vitrified clay tile pipe buried as much as 8 m deep. This deep burial precluded safe entry into the trench, so overburden was excavated with a deep-reach backhoe to within 1 m of the pipe. From that level down to undisturbed tuff (the soft volcanic rock underlying Los Alamos), the pipe and soil were removed with the backhoe and sent to the radioactive waste disposal area. All phoswich readings, micro-R meter readings, and gross alpha analyses on soil samples showed no measurable contamination. The sample locations were documented using a special linear system starting with station 00+00* (0 ft) at ULR-60 and ending with station 01+95* (195 ft) at ULR-35 (Fig. 18).

A domestic water line, between ULR-35 and ULR-60, located approximately 7 m above the clay pipe, was accidentally ruptured during this excavation. The water released was impounded (Fig. 27) and sampled for the presence of radioactivity. None was detected. The uncontaminated water was then pumped into nearby Los Alamos Canyon. After the water was removed, mud samples were collected and the absence of gross-alpha activity was confirmed. The trench was backfilled with pulverized tuff to absorb moisture. This material was then reexcavated and sent to the disposal area to permit resampling of the trench. No gross-alpha activity was detected at any time.

Fig. 20.
Excavation at manhole ULR-35.

Fig. 21.
Excavation of manhole ULR 35

Fig. 22.
Inadequately sealed outlet port in manhole ULR-35.

Fig. 23.
Manhole ULR-35 is loaded on a lowboy trailer.

Fig. 24.
Manhole ULR-35 is secured on a lowboy trailer.

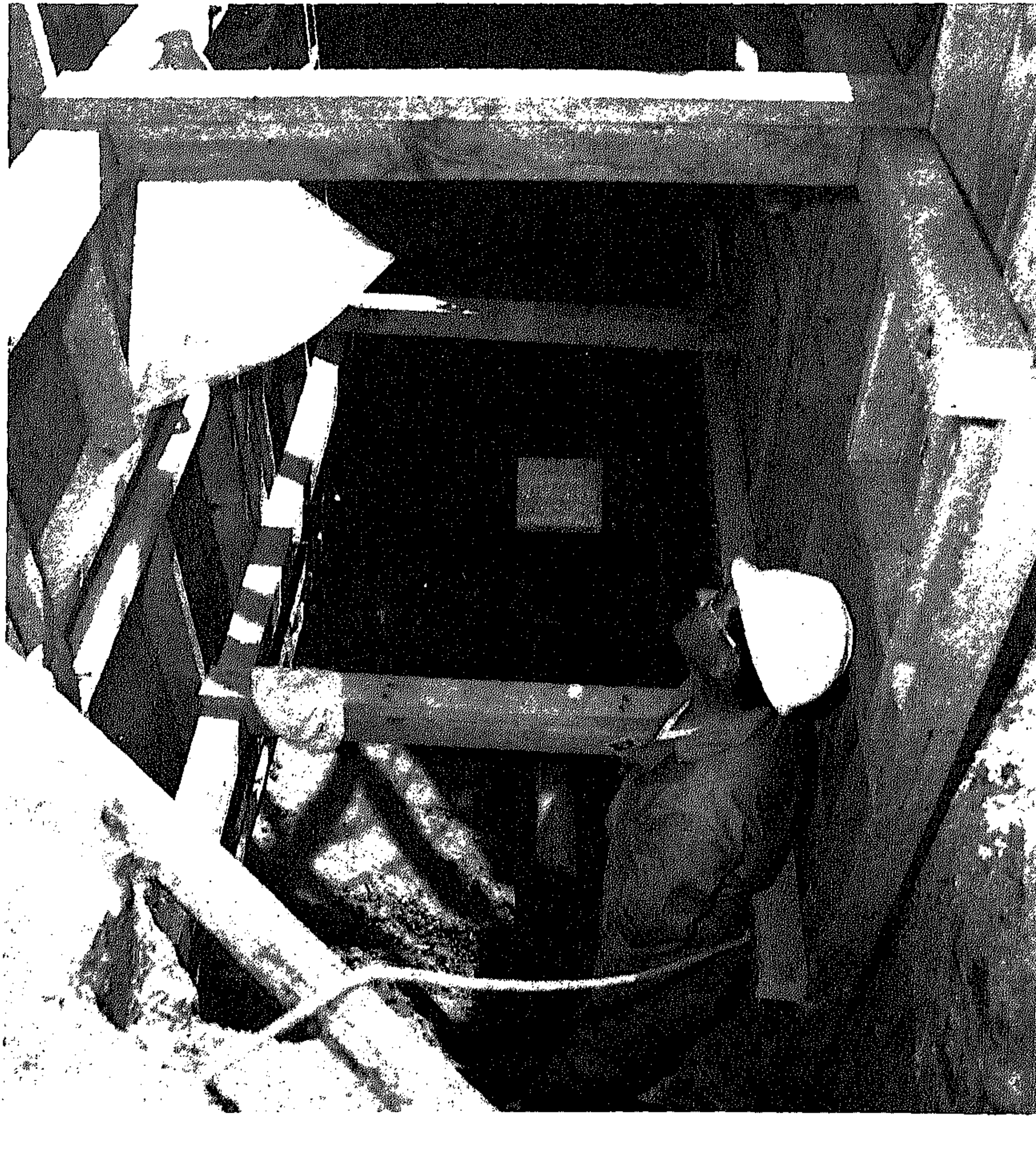

Fig. 25

Fig. 27.

A domestic water line, between manhole IU R-35 and IU R-60, is accidentally ruptured dur-

4700 pCi/g. Consequently, the inlet and outlet ports were grouted from the inside, the lid welded shut, and the structure unearthed and sent to the disposal site (Fig. 28). After decontamination, gross alpha analyses of soil samples from the excavation were all ≤25 pCi/g. The inlet pipe from TA-43 had no detectable activity, so was sealed with a concrete plug. The IWL section between ULR-60 and ULR-61 was left in place. This was considered to meet criteria of practicability since no gross-alpha activity was detected and since it is 4 m deep and runs under the Los Alamos Medical Center.

G. Manhole ULR-61

Up to 400 pCi/g gross-alpha activity was found in the inlet/outlet pipe in the base of ULR-61. This structure on DOE property was not scheduled for removal during this project. The inlet and outlet pipes were sealed with cement and the structure left in place.

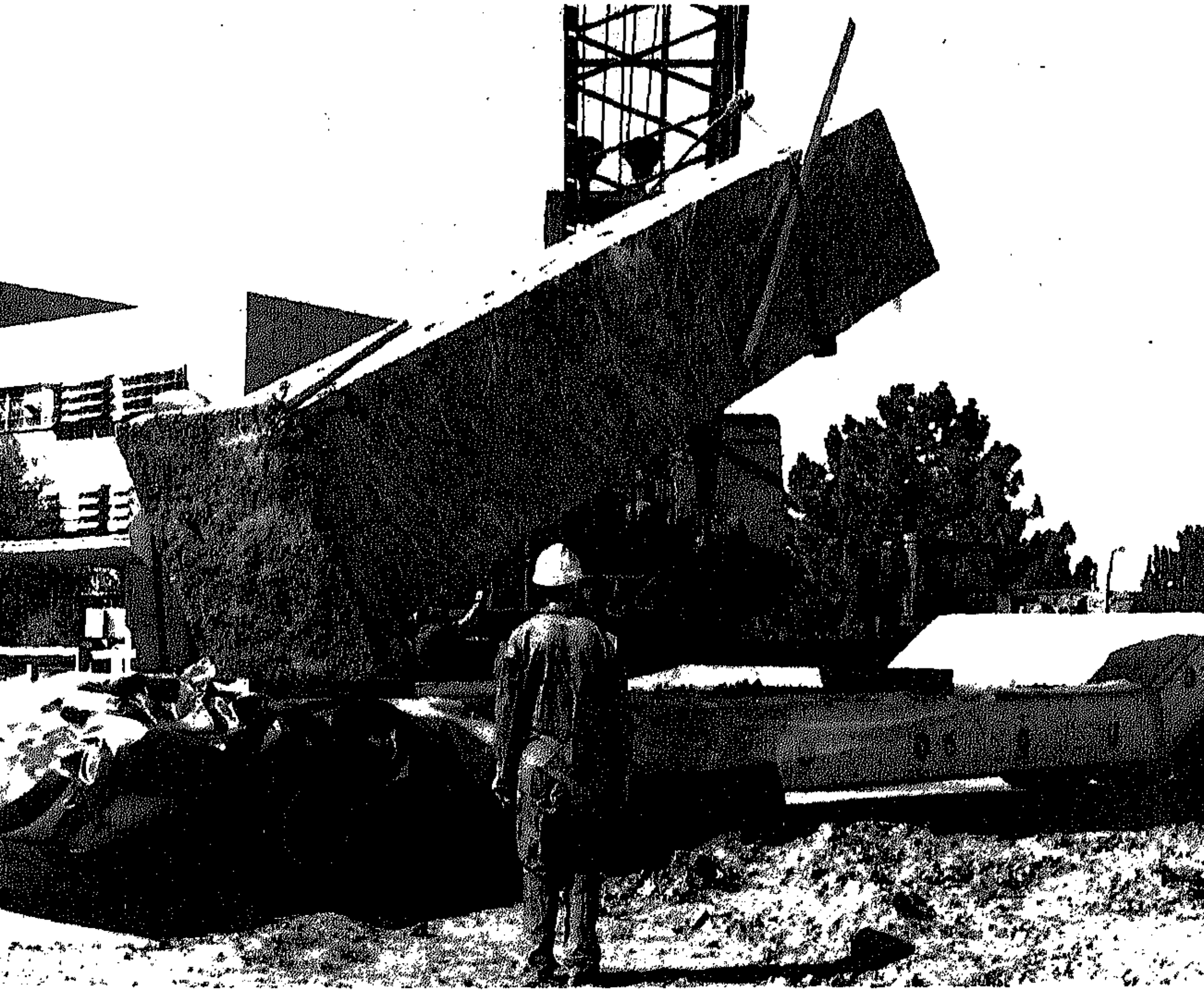

Fig. 28.
Disposal of Manhole ULR-60.

contamination of 49 pCi/g was found under one crack; the area was decontaminated to ≤25 pCi/g.

Fig. 29.
Crack in exposed cast iron IWL under Los Alamos Canyon bridge (27+19 to 27+74).

A. As Low As Practicable

There are no official national standards established for contamination in soil although there are several suggested or recommended standards for plutonium in soil.[7-9] Throughout the survey and decontamination operations on this project, decontamination was done to a point where residual contamination was as low as could practically be achieved. "As low as practicable" (ALAP) is a long-standing radiation protection philosophy that is stated DOE policy. ALAP essentially indicates that any exposure to ionizing radiation should be held to the minimum level achievable, taking into account the economic and practical realities of the given situation. No fixed upper level of contamination was kept in mind except that areas of several hundred pCi/g were scrutinized carefully to see if more excavation would reduce the levels further.

In the application of the ALAP principle, it was necessary to define methods of measurement below which one would not be concerned. Normal techniques consist of the use of portable survey instruments, field sampling and chemical analysis of samples. For alpha emitters the portable survey instruments are relatively insensitive in an environmental situation because of high absorption of the alpha particles by overlying material. Sole reliance on these instruments would undoubtedly have left material well above the level of several hundreds of pCi/g. Chemical analysis, involving soil dissolution, is sensitive to small fractions of a pCi/g, but the results represent only a small portion of the soil in the area; the expense and time required is such that large numbers of samples could not be done. Of primary importance here is the fact that survey and decontamination operations were done simultaneously. When a contaminated area was located, soil removal began. Frequent sampling was required to assess the progress and to indicate when the operation could be stopped. Since chemical analyses require days to complete, this would mean that the crews would have to shift from one area to another or wait for results. This would have increased cost and effort by a large factor.

It was, therefore, decided to use sampling and results from the ZnS measurement technique[4] as the basis for final decisions on samples analyzed for gross alpha. This technique had been tested on other cleanups[10,11] and gave reasonable, reliable results when checked against radiochemical analyses. It did not give as good a sensitivity as radiochemical analyses, but results could be obtained in a relatively short time so that a larger number of samples could be taken and the crews directed promptly. In an attempt to, at least partially, overcome the sensitivity problem, excavations were generally carried somewhat beyond the point of detection in many samples, although one area with low positive levels remained.

Decisions on as low as practicable are difficult on a case-by-case basis, because there are no fixed standards and the decision is largely judgemental as to the gain obtained from further effort. The final decision responsibility was delegated to the DOE's Los Alamos Area Office by DOE's Albuquerque Operations Office. Thus, LASL's job was to carry out the operations and make recommendations as to where to proceed and when to stop.

B. Remaining Contamination Considerations

A natural question now that the work is finished is, "How complete was the decontamination and what are the health hazards that are possibly left?" As can be seen from the data (Appendix B; Figs. B-1 through B-31), contamination was primarily low-level (<200 pCi/g) and was infrequently encountered. Obviously, contamination was localized along pipe trench or the manhole excavations with most contamination being associated with manholes. Lack of contamination in the trenches was likely because the line from SM-700 to TA-45 was made of 10-cm diam cast iron

material. The line from TA-43 was a clay pipe that carried low levels of activity. No contamination was found in the soil from that trench. Samples in the main trench were taken in all places with leak potential (pipe joints, line breaks, etc.). This sampling coupled with phoswich and micro-R meter surveys gives reasonable assurance no hot spots of contamination were overlooked. However, the use of measuring devices with relatively poor sensitivity, for the reasons described earlier, also means that in some locations it may be possible to find contamination above background.

The question of possible hazard to people in this area is difficult to answer without some qualification, because of the widely accepted assumption that any radiation, no matter how small, will result in some incremental hazard. Thus, even in regions where background levels are much higher than the contamination left, it is usually presumed that there is some small risk, although studies have not been able to detect it.

However, in the area as it was left, any low-level residual contamination has been buried under fill used to restore the area. The spots of contamination discovered during exploration and decontamination were relatively small in size so that even if they were on the surface, the buildup of resuspension concentrations from winds would be lower than from a large area and, in fact, the time of occupancy in the small area would be short. Excavation into these areas would produce a slight increase in probability of inhalation but, at the levels remaining, it is very doubtful that the potential intake would be significant or could even be measured by the most sensitive techniques presently available. Prior to excavation, any real risk of exposure was low and largely predicated upon excavation into a spot of higher contamination concentration than was found. Any contaminated material that remains from this trench or any previously excavated trench is no hazard as long as there is no excavation because the alpha particles and weak x-rays associated with alpha decay cannot penetrate that much soil (≥ 1 m) and there is no major transport mechanism into the biosphere.

If excavation of any remaining contaminated soil occurred, what would the potential hazard be? A good representation would be that experienced by the personnel who excavated and removed the pipe on this project. These personnel were in close proximity to the contaminated soil along the entire length of the pipe.

As discussed in Sec. II.D.1., there was no detectable exposure to personnel and all air samples near actual operations had gross-alpha activity below detection limits which were 0.7% of the Radioactivity Concentration Guide (RCG) for ^{239}Pu for the occupational worker or 23% of the uncontrolled area RCG, which is based on continuous exposure to a member of the public.[6] If the workers along the trench received no detectable exposure while actively digging above the entire trench and there was no detectable airborne alpha activity, it is highly unlikely that a person excavating a portion of the trench would receive any significant exposure.

The four sections of IWL still under roads on county property (under Rose, Central, and two under Canyon; Fig. 18) are likely to be mildly contaminated as was the rest of the IWL. Since these are presently plugged with concrete, there is little likelihood of the contamination being transported into the soil in the near future. Soil surrounding these pipes should have no greater contamination than that already encountered. Removal of these pieces of pipe is included in plans for replacing the entire IWL which are being submitted in a specific line item in the DOE budget for fiscal year 1978.

All manholes on private land between point of waste origin and TA-45 (ULR-36, -37, -62; Fig. 4) and in TA-1[11] are listed as having been removed. Several old records, however, indicate that ULR-36 or -62 was too difficult to remove so was broken up and sealed with cement. Locations of

APPENDIX A

EFFORT BREAKDOWN

TABLE AI

EQUIPMENT USE AT IWL REMOVAL PROJECT
1977
(hours)

	3/21-3/25	3/28-4/3	4/4-4/8	4/11-4/17	4/18-4/23	4/25-4/30	5/2-5/8	5/9-5/15	5/16-5/20	5/23-5/27	6/13-6/17	Totals
	---	33	142	95	127	146	141	156	68	52	9	969
r	17	28	56	85	90	86	88	70	42	20	7	589
der	7	15	20	31	48	50	44	27	39	10	---	291
	---	---	4	---	---	---	3	---	---	---	---	7
	---	---	10	25	33	35	40	35	28	18	---	224
	---	---	2	2	7	12	---	6	---	---	---	29
	---	---	4	2	9	2	---	11	2	9	2	41
	24	76	238	240	314	331	316	305	179	109	18	2150

TABLE AII

ZIA PERSONNEL CHARGES TO THE IWL REMOVAL PROJECT
1977
(man-hours)

eek of	3/11-3/25	3/28-4/3	4/4-4/8	4/11-4/17	4/18-4/23	4/25-4/30	5/2-5/8	5/9-5/15	5/16-5/20	5/23-5/27	6/13-6/17	Totals
arpenters	94	48	28	107	81	62	26	54	36	8	---	544
ectricians	4	---	---	6	---	2	---	---	---	---	---	12
tters	---	---	---	---	---	---	9	---	---	---	---	9
on Workers	40	14	---	8	87	8	46	---	---	---	---	203
nitor	---	---	---	---	1	1	1	---	---	---	---	3
aborers	98	298	253	492	362	333	334	381	226	86	18	2881
perators	50	71	67	103	83	87	116	76	44	23	16	736
ainters	80	16	58	76	8	---	---	---	---	---	---	238
eamsters	57	49	108	160	129	129	218	118	82	35	4	1089
nners	12	---	14	---	3	---	---	---	---	---	---	29
otals	435	496	528	952	754	622	750	629	388	152	38	5744

TABLE AIII

SUMMARY OF MANPOWER SUPPLIED BY LASL
FOR THE IWL REMOVAL PROJECT
1977
(man-months)

	March	April	May	June	July	Aug	Sept	Oct*	Nov*	De
ironmental Studies										
ofessional	0.4	1.0	1.0	---	---	---	---	1.0	1.0	1.
chnician	0.3	1.0	1.0	---	---	---	---	---	---	0.
lth Physics										
ofessional	0.4	1.0	1.0	0.4	---	---	1.0	---	---	--
chnician	0.5	2.0	1.6	0.5	---	---	---	---	---	--
struction										
ofessional	---	0.8	0.5	---	0.1	---	---	---	---	--
chnician	---	1.6	1.5	---	0.1	---	---	---	---	--
ision Offices										
ofessional	0.1	0.1	0.1	---	---	---	---	---	0.1	--
chnician	---	---	---	---	---	---	---	---	---	--
als										
ofessional	0.9	2.9	2.6	0.4	0.1	---	1.0	1.0	1.1	1.
chnician	0.8	4.6	4.1	0.5	0.1	---	---	---	---	0.

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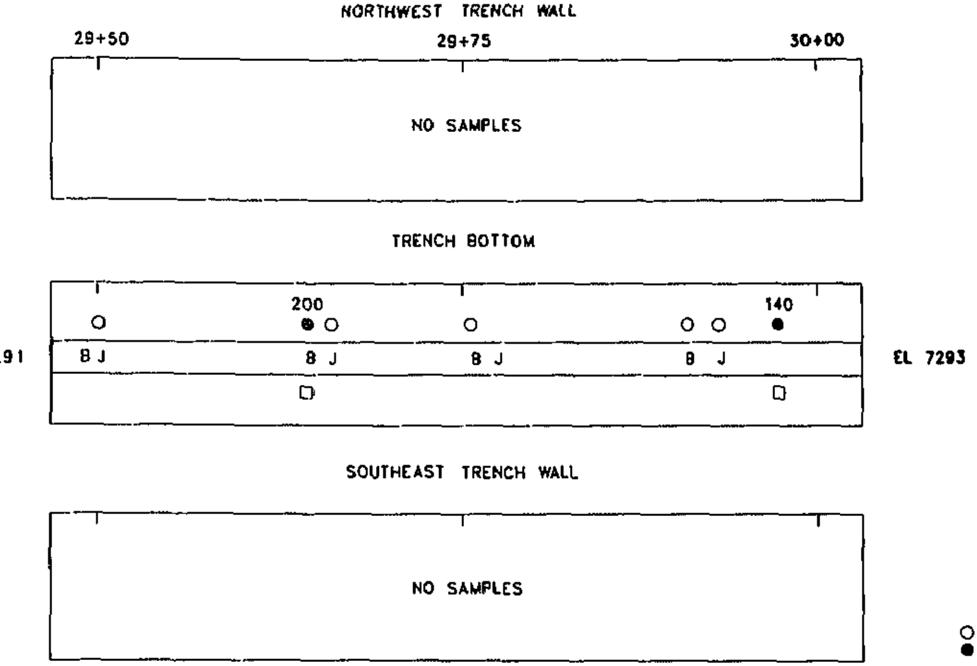
SOIL SAMPLE LOCATIONS AND RESULTS



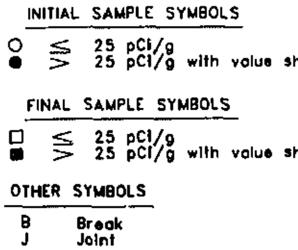


Fig. B-1.
Soil sampling results from 29+60 to 30+00.

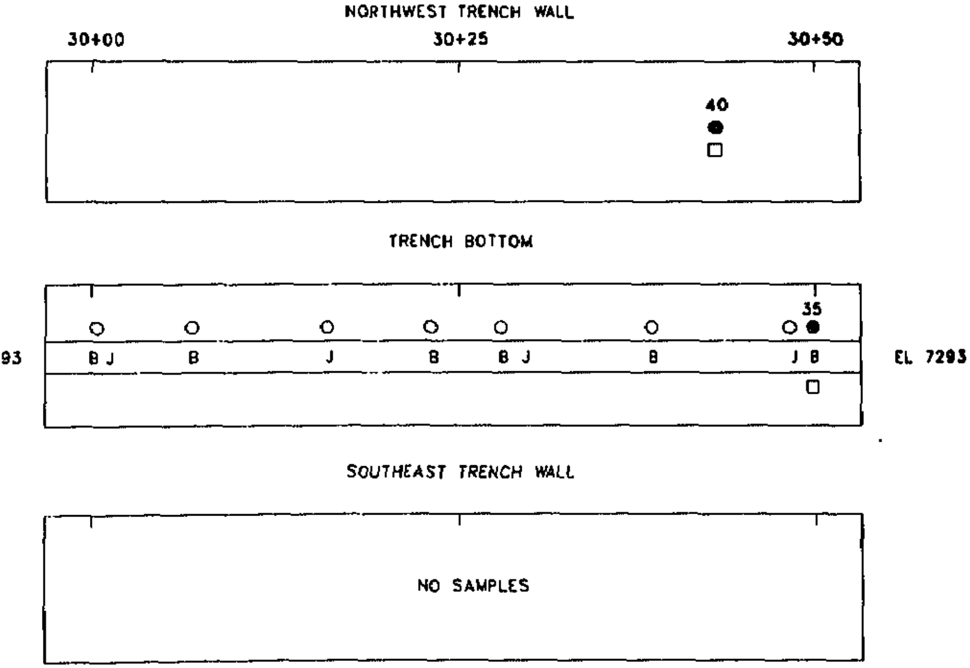
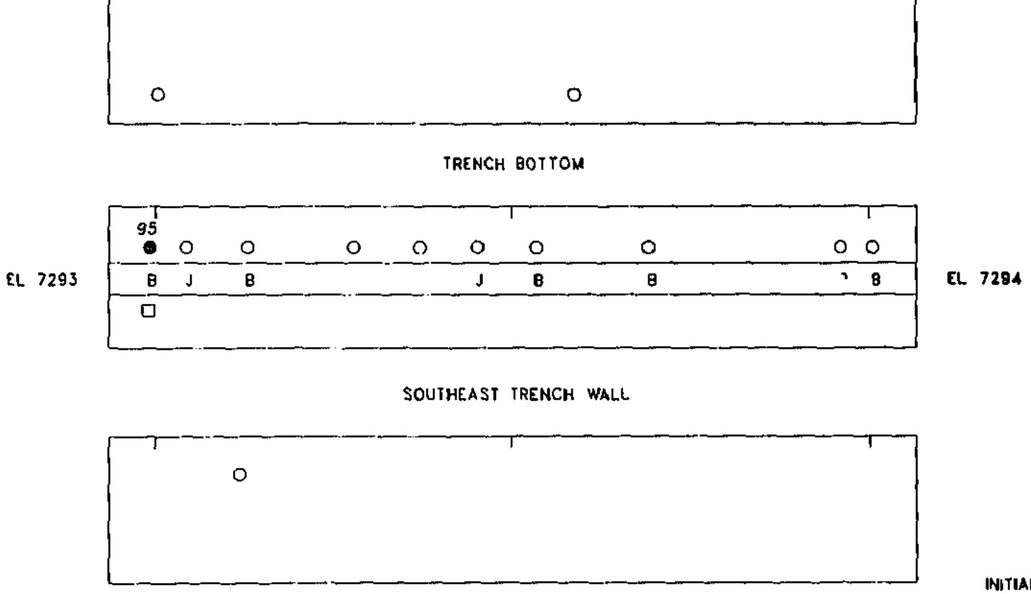


Fig. B-2.



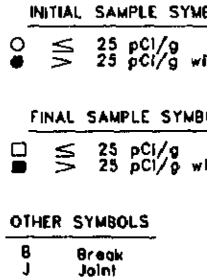


Fig. B-3.
Soil sampling results from 30+50 to 31+00.

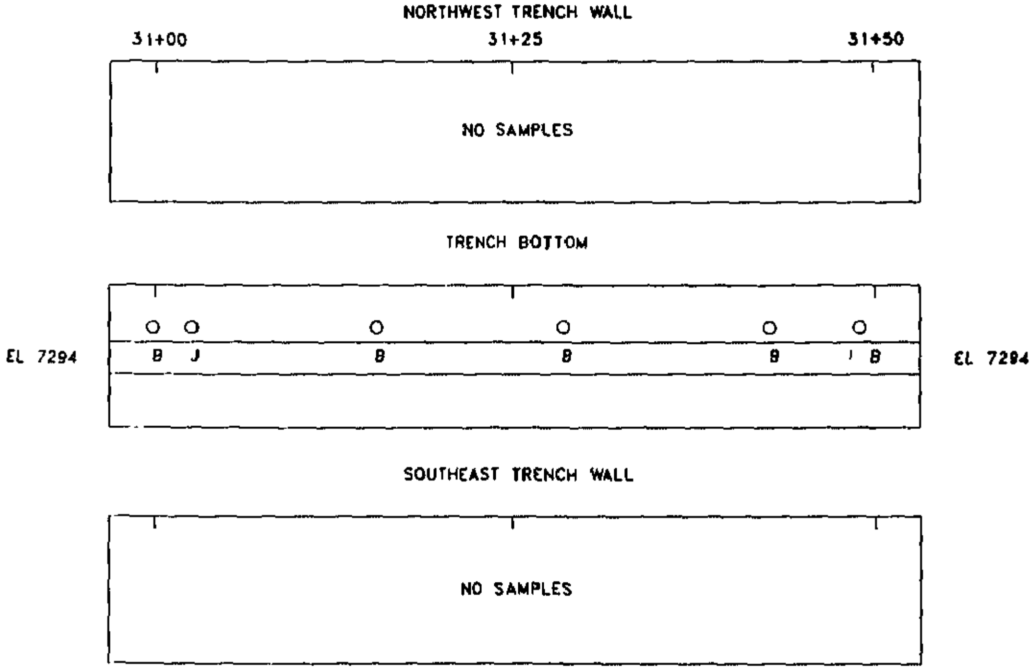


Fig. B-4.
Soil sampling results from 31+00 to 31+50.